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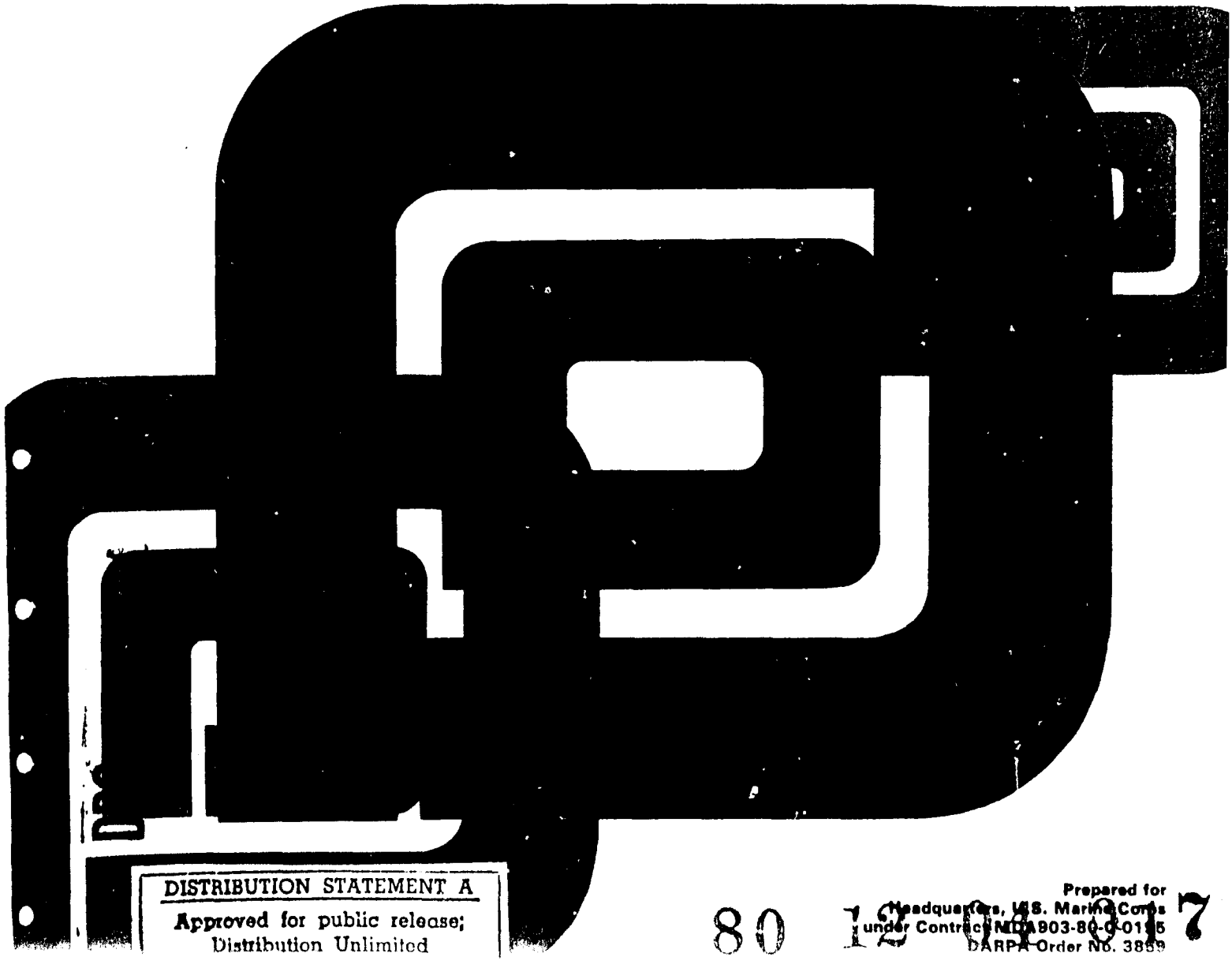
Users Guide to Accompany the Computerized Training Requirements and Cost Evaluation System for the U.S. Marine Corps

John F. Patterson
Michael L. Donnell

DECISIONS and DESIGNS, INC.



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USERS GUIDE UG 80-2-315.3

USERS GUIDE TO ACCOMPANY THE COMPUTERIZED TRAINING REQUIREMENTS AND COST EVALUATION SYSTEM FOR THE U.S. MARINE CORPS

by

John F. Patterson and Michael L. Donnell

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Headquarters, U.S. Marine Corps

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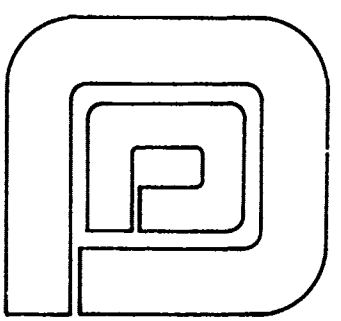

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This users guide accompanies Decisions and Designs, Inc. technical report, Development of a Computerized Training Requirements and Cost Evaluation System for the U.S. Marine Corps (TR 80-5-315.3). This guide describes the computer software implementation of the Marine Corps Training and Cost Evaluation System (TRACES) known as CTRACES (or Computerized TRACES). TRACES has been designed to function as the resource allocation component of the Marine Corps' training resource management system at the battalion level. The evaluation

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component of that system is the previously developed Marine Corps Combat Readiness Evaluation System (MCCRES). CTRACES is used in conjunction with MCCRES Software Application (MCCRESSA) to assist battalion commanders in developing cost-effective strategies for allocating funds for remedial training based upon their unit's MCCRES scores. In addition, battalion commanders will be able to evaluate the expected benefit and cost of particular training packages that they, or others, have proposed for consideration. The computer used for implementing CTRACES is the IBM 5110 portable computer and can be operated in either APL or BASIC programming languages.

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FIGURES

1.0 INTRODUCTION

This User's Guide has been developed to assist the user in the operation of the computer software implementation of the Marine Corps' Training and Cost Evaluation System (TRACES). The computer module has been labeled CTRACES for Computerized TRACES. TRACES has been designed to function as the resource allocation component of the Marine Corps' training resource management system at the battalion level. The evaluation component of that system is the previously developed Marine Corps Combat Readiness Evaluation System (MCCRES). CTRACES is used in conjunction with MCCRES Software Application (MCCRESSA), to provide the battalion commander with detailed information concerning the following items: (1) the nature, magnitude, and importance of his MCCRES deficits; (2) the value of the various remedial training options that he might consider in terms of their cost and the number of MCCRES points they would be expected to make up; and (3) alternative training packages to those he might be considering which are cheaper and/or better, along with information on the nature of their benefit for specific tasks. The ultimate goal of TRACES is to provide the battalion commander with an aid in accomplishing the difficult task of allocating, in a cost-effective manner, his discretionary remedial training funds. If this goal is achieved on a unit-by-unit basis, then the USMC will, as a whole, be as combat-ready as possible.

2.0 EQUIPMENT AND OPERATION

2.1 Equipment

The computer used for implementing CTRACES is the IBM 5110 portable computer (shown in Figure 2-1). The following section briefly describes the equipment that you will use. Remember that there are no typewriter keys or switches that you can press that will damage the equipment. If you make a mistake, or an omission, there will always be the opportunity for corrections.

The IBM 5110 has five components which comprise the basic self-contained system illustrated in Figure 2-1. These are the operator selection switches, display screen, keyboard, tape drive, and the central processor with its associated memory. In addition, a printer and disk drive accompany this basic unit.

2.1.1 Operator selection switches -

- L32 64 R32 - This three-position switch allows the user to display the left 32 characters of the display (position L32), the right 32 characters (R32) or the entire display of 64 characters (64). Operation of the CTRACES program requires that this switch be in the center position (64).

- Reverse Display - Some users prefer viewing a black-on-white image to a white on black. The Reverse Display switch allows the user to select the type of image he prefers. It should be noted that reversal of the display will require a brightness adjustment. Also, the Reverse Display switch will not affect the image displayed on an auxiliary TV monitor.

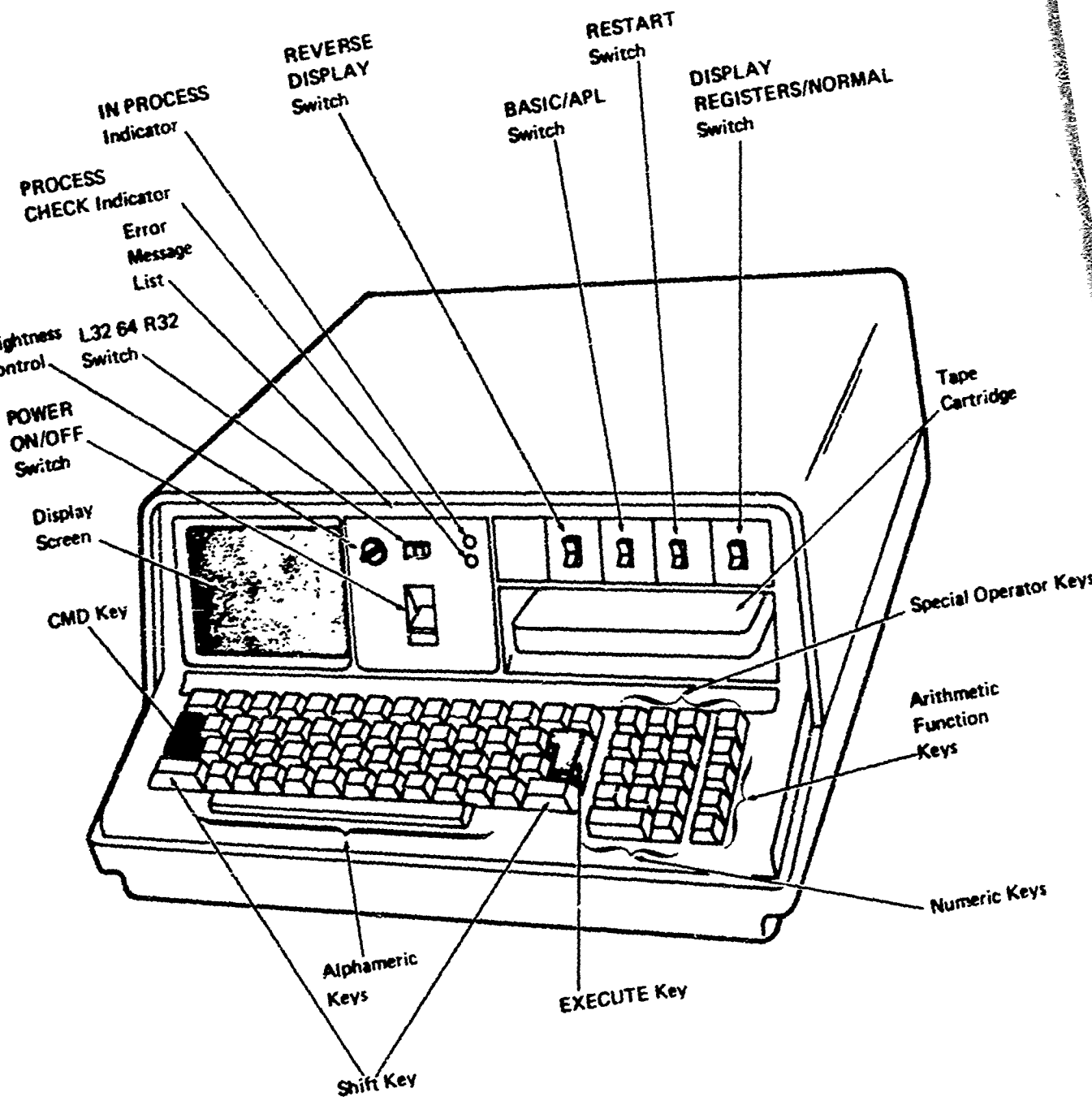


Figure 2-1
CONSOLE OF THE IBM 5110 PORTABLE COMPUTER

- BASIC/APL - The CTRACES program is written in APL (A Programming Language), and this switch must be in the APL position. By placing the switch in the BASIC position, the computer is configured to operate in the BASIC language.

- RESTART - The RESTART switch is used to re-initialize the IBM 5110. Depressing this switch is equivalent to turning off power to the machine and restarting.

- Display Registers/NORMAL - This switch should be in the NORMAL position when operating the CTRACES program. The Display Registers position provides a display of internal machine code used in diagnostic testing of the machine.

2.1.2 The display - The display is a cathode ray tube (CRT) which allows 16 lines of data to be displayed. Each line may contain up to 64 characters. The computer scrolls each line from bottom to top. Lines that scroll off the top are lost. The display screen has two functions:

a) As you type characters, these will appear on the bottom two lines of the screen. A flashing cursor (-) will indicate where the next character will be entered.

b) The computer will help you organize and summarize the data that you enter. Tables of these data will be displayed on the upper 14 lines of the display.

When the 5110 is making computations, the screen will often go blank, and the red (IN PROCESS) light will be illuminated.

2.1.3 The keyboard - The layout of the IBM 5110 keyboard is similar to that of a standard typewriter. As you will note, many of the keys have special symbols embossed over the standard typewriter characters. These symbols are used to write programs in the APL language and are not necessary when operating the CTRACES program.

In addition to the standard keyboard, note that the 5110 has a numeric keypad similar to that of an adding machine. These keys are interchangeable with the numbers appearing in the top row of the keyboard, and many users find them more convenient to use.

As characters are typed, they appear on the display at the location identified by the cursor. In general, this will occur on the bottom line of the display screen.

Finally, there are a number of additional keys that perform special functions. These keys are discussed below.

SHIFT

The SHIFT key performs the same function as a Shift key on a typewriter.

FORWARD SPACE

When this key is pressed once, the cursor moves one position to the right. When this key is held down, the cursor continues to move to the right. When the cursor reaches the last position on one input line, it goes to the first position on the next input line.

BACKSPACE

When this key is pressed once, the cursor moves one position to the left. When it is held down, the cursor continues to move to the left. When the cursor reaches position 1 on one input line, it goes to the last position on the previous input line.

HOLD

When pressed once, HOLD causes all processing to stop; when pressed again, it allows processing to resume. The primary purpose of HOLD is to permit reading the display information during an output operation, when the display is changing rapidly. When the hold is in effect (HOLD pressed once), only the COPY DISPLAY key is active.

EXECUTE

When this key is pressed, the input line of information on the display screen is processed by the system. This key must be pressed for any input to be processed.

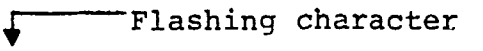
ATTN

The ATTN key erases from both the computer's memory and the display screen everything beyond the space where the flashing cursor is positioned. It does not erase anything before the flashing cursor.

INSERT

When the CMD key is held down and the forward space is pressed once, the characters at and to the right of the cursor position (flashing character) are moved to the

right one position, and a blank character is inserted at the cursor position. The cursor does not move. For example:



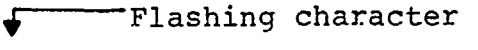
Before the insert operation: 123567

After the insert operation: 123_567

When these keys are both held down, the characters continue to move to the right, and blank characters continue to be inserted.

DELETE

When the CMD key is held down and the backspace key is pressed once, the character at the cursor position (flashing character) is deleted, and all characters to the right are moved over one position to the left to close up the space. The cursor is not moved. For example:



Before the delete operation: 1234456

After the delete operation: 123456

When these keys are both held down, the characters at the cursor position continue to be deleted, and all the characters to the right are moved to the left.

2.1.4 The tape cassette - In many cases, this device is used to store the programs and data used by the 5110. In the case of CTRACES, however, the tape cassette is not used. The disk drives are used instead.

2.1.5 The central processor and memory - The central processor is a microprocessor developed by IBM. This unit executes the commands stored in the computer's memory.

2.1.6 The printer - The printer, when turned on, will print each line of the CRT screen exactly as it is displayed. It will be to your advantage to maintain printouts of many of the displayed tables. Many of the tables are too long for the display, and the top portion will scroll off the display. It is often easier to read these long tables from the printer rather than from the display screen.

The disadvantage of the printer is that it is significantly slower than the CRT display and will slow your progress. At different points in the exercise, the computer may suggest turning the printer on or off. However, the operation of the printer is completely up to you.

If at any time the information on the display screen seems important enough to record, a printed copy can be obtained by turning on the printer then simultaneously pressing the CMD button and the X button.

2.1.7 The disk drives - The disk drives are used to store the programs and data used by CTRACES. Before starting the program, it must be loaded from a diskette. Also, data from a MCCRESSA diskette must be loaded in order to merge this information with the CTRACES program. The computer automatically handles the control of the disk drives, but the user must physically load the diskette in the machine. This is done by holding the disk in a vertical position with the label on the right and away from the machine.

2.1.8 Potential problems - The CTRACES program has many internal safeguards which should prevent most problems, but there are a few things that can go wrong.

TYPING MISTAKE

The first problem that is likely to occur is that a user will mistype a response to the computer. This is very easy to correct. Prior to depressing the EXECUTE key, simply type over the portion of the response that is incorrect utilizing the Space Forward and Space Back keys. Remember that the computer will not process a user response until the EXECUTE key is depressed.

PROCESS CHECK ERROR

If the Process Check Light (Figure 2-1) comes on, the computer has encountered internal problems. Depress RESTART and try again. If the light comes on again, an IBM Service Representative should be notified.

2.2 Starting Up the System

Turn on the IBM 5110 and check the position of the operator selection switches. If the printer is to be used for recording the output displays, make sure that it is connected prior to turning on the 5110. Do not connect or disconnect either the printer or the disk drives in the middle of any operation. To connect the printer and disk drive, screw the box-like appendage of the printer into the back of the disk drive, then screw the similar appendage of the disk drive into the back of the 5110. Be sure that all three units, the 5110, the printer, and the disk drive are plugged in.

When the computer has completed its internal check, the following display will appear in the lower left of the display screen:

CLEAR WS

Insert the CTRACES diskette and type either of the following instructions:

```
)LOAD COMPUTE
      or
)LOAD DISPLAY
```

Press the EXECUTE key, and the computer will begin the designated part of the CTRACES program. (See Section 3.0 for a discussion of the distinction between the COMPUTE and DISPLAY work spaces.)

2.3 Bringing Down the System

When the user is finished with his work, he can bring down the system by removing his diskette, turning the computer power off, and turning the printer off. This can be done whenever the computer is waiting for a user input but should not be done while the printer or disk drive is operating. Do not turn off the power before removing the diskette.

3.0 THE CTRACES SYSTEM ORGANIZATION

The CTRACES system indicates how to improve a battalion's combat readiness. This analysis combines assessments of a battalion's combat deficiencies with assessments of the cost and efficiency of various training options. While the assessments of cost and efficiency are programmed into the CTRACES system, the assessments of combat deficiency are not and must be obtained from a MCCRESSA analysis. Once these data have been brought over into the CTRACES program, it is possible to carry out the TRACES analysis.

CTRACES has two major components which are called work spaces. The first is called the COMPUTE work space and is used to read the MCCRESSA data, perform appropriate calculations, and store their results on the CTRACES disk. The second is called the DISPLAY work space and is used to examine the results of the TRACES analysis. The nature and operation of these work spaces is clarified in the sections that follow.

3.1 The COMPUTE Work Space

Whenever a new MCCRESSA analysis must be incorporated into CTRACES, the user should start by entering the COMPUTE work space. This is done by typing

```
)LOAD COMPUTE
```

followed by pressing EXECUTE.

Eventually, the computer should display the following message:

```
THIS PROGRAM CAN TAKE UP TO 25 MINUTES TO EXECUTE AND
CANNOT BE INTERRUPTED UNTIL FINISHED.
DO YOU WISH TO CONTINUE?
```

The purpose of this message is to permit the user an opportunity to exit the COMPUTE work space in case his entry was unintended. Typing 'Y' will cause CTRACES to continue. Typing 'N' will return the program to its initial state.

Having elected to continue, the following message appears:

```
INSERT THE MCCRESSA DISC CONTAINING CURRENT EVALUATION
RESULTS INTO DRIVE ONE.
PRESS EXECUTE TO CONTINUE...
```

At this point, the CTRACES diskette should be removed and the MCCRESSA diskette should be inserted in its place. After EXECUTE is pressed, CTRACES will eventually request the following:

```
INSERT TRACES DISC INTO DRIVE ONE.
PRESS EXECUTE TO CONTINUE...
```

Now the MCCRESSA diskette must be removed and the CTRACES diskette reinserted. Once the original diskette is back in place, the user should press EXECUTE.

After 15-30 minutes, the following message will appear:

This indicates that the compute operation is complete and that the analysis can proceed by typing

```
)LOAD DISPLAY
```

followed by EXECUTE. The necessary MCCRESSA data is actually stored on the CTRACES diskette and need not be regenerated each time the CTRACES results are examined. Since the diskette holds the data of only one MCCRESSA analysis, it must, however, be recomputed if new or different MCCRESSA results are to be analyzed.

3.2 The DISPLAY Work Space

Either upon first entering CTRACES or after using the COMPUTE work space, the user can enter the DISPLAY work space by typing,

```
)LOAD DISPLAY
```

followed by EXECUTE. This causes CTRACES to display its main menu which reads as follows:

```
1) POINTS TO MAKE UP
2) PARETO PACKAGES
3) SPECIFIED PACKAGE

ENTER THE NUMBER OF THE DESIRED OPTION
```

Before discussing the options offered in the main menu, it is necessary to first discuss CTRACES' menu system. CTRACES uses a hierarchy of menus to organize the various options which it offers. Figure 3-1 depicts this arrangement of options and suboptions. Those options appearing within a box are presented together on a menu. Any option with an arrow leading out from it has suboptions, which will appear in a menu once that option is selected. Once the user reaches the bottom level in the hierarchy, CTRACES implements the request (see the following sections for details).

This hierarchical organization of menus is quite simple to use provided that the user remembers where he is in the hierarchy and what the rules are for moving from one level to another. Lower level menus appear as soon as the appropriate higher level option is selected by typing its number followed by EXECUTE. Once a request is implemented, CTRACES

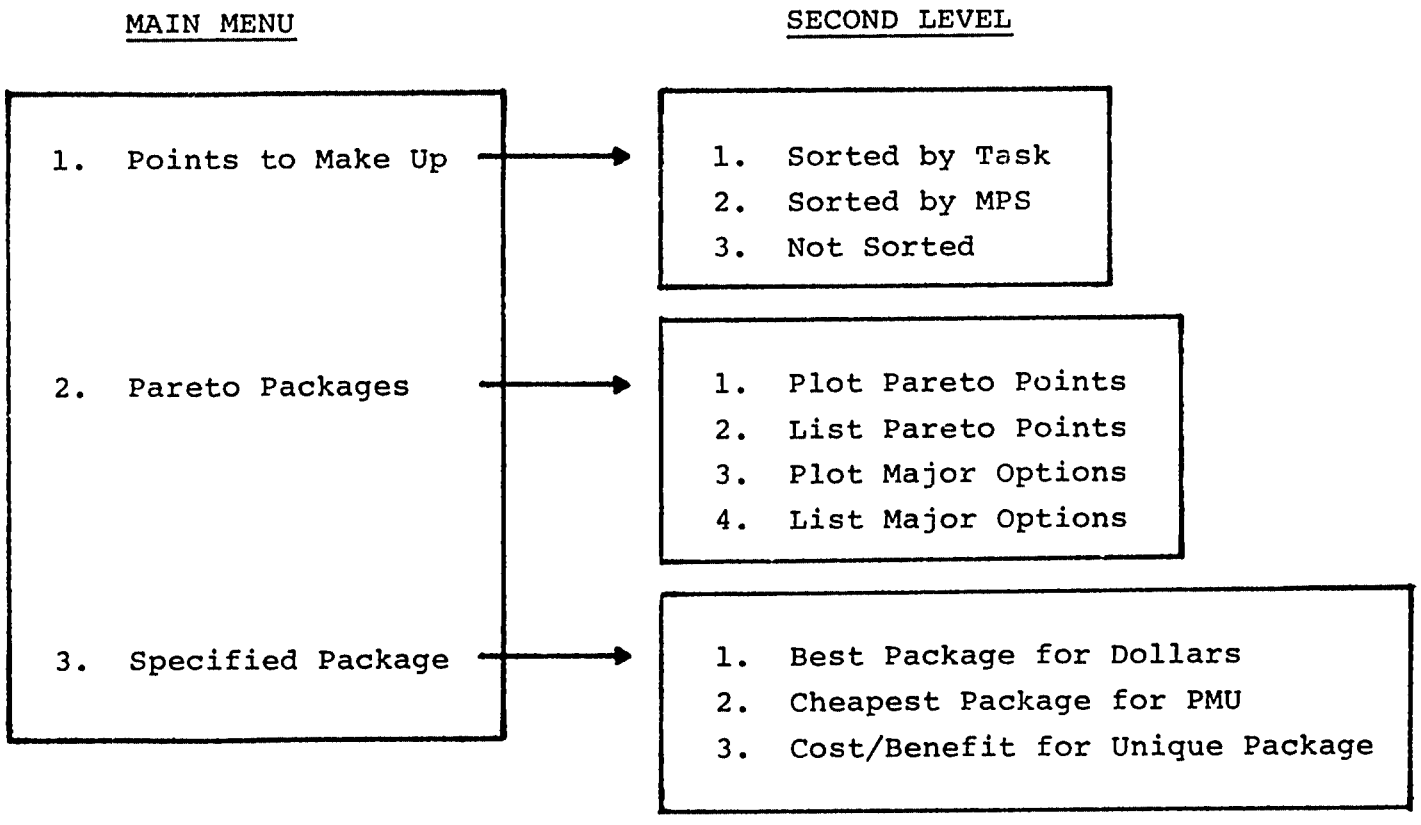


Figure 3-1
CTRACES HIERARCY OF OPTIONS

returns to the last menu that appeared. Without any additional capability, the tendency to simply return to the last menu would eventually trap the user at a low-level menu and make it impossible to continue. To overcome this difficulty, CTRACES permits the user to return from any low-level menu to the next higher level menu by pressing EXECUTE alone. Thus, movement down through the hierarchy (left to right in Figure 3-1) requires a number followed by EXECUTE, while movement up requires an EXECUTE alone.

The sections that follow describe the various options in greater detail.

3.2.1 Points to Make Up - The first item of the main menu offers the user an opportunity to examine the Points to Make Up. Points to Make Up corresponds to a battalion's deficit score on the MCCRESSA evaluation. Thus, the Points to Make Up option allows the user to examine a battalion's weaknesses without yet asking how these deficiencies can be alleviated.

Upon selecting the Points to Make Up option from the main menu, the user will be presented the following:

```
1) SORTED BY TASK
2) SORTED BY MPS
3) NOT SORTED

ENTER THE NUMBER OF THE DESIRED OPTION.
```

Each of these suboptions provides a list of the MCCRESSA tasks and their corresponding deficit scores; however, in each case, the tasks are listed in a different order. The next three sections clarify these differences and provide examples of each type of list.

3.2.1.1 **Sorted by Task** - Upon selecting the Sorted by Task suboption of the Points to Make Up option, the user will observe the following message:

TURN THE PRINTER ON, ALIGN FORMS, PRESS EXECUTE TO CONTINUE

This offers the user an opportunity to turn on the printer and align the paper to a new page. When this is completed, he should press EXECUTE.

At this point, CTRACES lists the tasks, ordered from those tasks yielding the greatest deficit to those yielding the smallest. A partial example of the output is provided below:

SORTED BY TASK

SECTOR		DEFICIT	%DEFICIT	CUMDEF	CUM%DEF
2.A.1.3	SEIZEOBJ	5.47	12.09	5.47	12.09
2.A.1.2	COVER	2.95	6.73	8.42	18.82
2.A.1.4	BUILDUP	2.11	4.66	10.53	23.48
2.A.1.10	ENEMYAIP	1.75	3.87	12.28	27.35
2.A.1.12	CASUALTIES	1.68	3.70	14.06	31.05
2.B.3.2	REMEARSAL	1.40	3.09	15.46	34.14
2.A.3.1	PSCOPERTN	1.25	2.77	16.71	36.91
2.B.2.1	TRANSIT	1.22	2.69	17.93	39.60
2.A.3.2	MISSIONPRO	1.22	2.69	19.15	42.28
2.A.3.3	MISSIONCLR	1.19	2.63	20.34	44.91
2.A.1.6	RECONPATRL	1.18	2.62	21.52	47.53
2.A.1.4	CAMOUFLAGE	1.17	2.58	22.69	50.11
2.A.3.7	TARGETINFO	1.09	2.41	23.77	52.52
2.B.6.3	FWDOFFEDA	1.05	2.31	24.82	54.83
2.A.1.5	SECURITY	1.02	2.25	25.85	57.08
2.A.2.12	REPORTS	1.01	2.22	26.86	59.30
2.A.1.2	DISPERSION	.98	2.17	27.84	61.47
2.B.3.6	COUNTFIRE	.89	1.97	28.73	63.44
2.B.1.4	FIRESPTPLN	.89	1.96	29.62	65.40
2.A.2.1	MANEUVER	.88	1.95	30.51	67.35
2.A.1.7	COMBATPTRL	.88	1.94	31.39	69.29
2.B.3.4	APPRCHMRCH	.86	1.90	32.25	71.19
2.B.6.4	ONFEDA	.84	1.85	33.09	73.04
2.A.2.2	ORGNIZEGRD	.82	1.82	33.91	74.86
2.A.1.11	POWS	.80	1.76	34.70	76.62

The column marked DEFICIT reflects the amount of the overall deficit of the MCCRESSA evaluation that is attributable to each task. The %DEFICIT is the percent of the total deficit attributable to each task. The CUMDEF is the cumulative deficit which compounds the deficit from each successive task in the list. Similarly, CUM%DEF is the cumulative percent deficit, which is obtained by adding the percent deficit over successive tasks. The last entry for CUM%DEF will always be 100.

Once CTRACES has completed this listing, the following message will appear:

TURN THE PRINTER OFF. PRESS EXECUTE TO CONTINUE.

Once this instruction is followed, CTRACES will return to the Points to Make Up submenu.

3.2.1.2 Sorted by MPS - The Sorted by MPS suboption allows the user to examine deficit scores in terms of the best and poorest MPS's. As with the Sorted by Task suboption, selection of this task first yields the following message:

TURN THE PRINTER ON. ALIGN FORMS. PRESS EXECUTE TO CONTINUE.

Once this instruction is followed, the listing will begin. A partial example of the listing follows.

SORTED BY MPS AND TASK

FACTOR		DEFICIT	%DEFICIT	CUMDEF	CUM%DEF
2.A.1	ACTNSBYMAR	12.77	28.19	12.77	28.19
2.A.1.3	COVER	3.05	6.73		
2.A.1.10	ENEMYAIR	1.75	3.87		
2.A.1.12	CASUALTIES	1.69	3.70		
2.A.1.6	RECONPATRL	1.18	2.62		
2.A.1.4	CAMOUFLAGE	1.17	2.58		
2.A.1.5	SECURITY	1.02	2.25		
2.A.1.2	DISPERSION	.96	2.12		
2.A.1.7	COMBATPTRL	.88	1.94		
2.A.1.11	POWS	.80	1.76		
2.A.1.8	ELECTRONIC	.26	.56		
2.B.1	SUPPACCLT	7.98	17.78	20.75	45.97
2.B.1.3	SEIZEBYJ	5.47	12.08		
2.B.1.4	BUILTUP	2.11	4.66		
2.B.1.1	DEBARKATN	.00	.00		
2.A.3	FSUPTCOORD	6.40	14.13	26.75	59.04
2.A.3.1	FSCOOPERTS	1.25	2.77		
2.A.3.2	MISSIONPLG	1.23	2.69		
2.A.3.3	MISSIONCLR	1.19	2.63		
2.A.3.7	TARGETINFO	1.09	2.41		
2.A.3.6	COUNTERIPE	.89	1.97		
2.A.3.5	DEFEDFIRE	.75	1.66		

In contrast to the Sorted by Task listing, the tasks are now sorted first by MPS and then by Task Within MPS. The four columns have the same interpretation as before. The two cumulative scores are, however, provided for only the MPS's and not for the individual tasks.

When the listing is completed, the user will be asked to turn off the printer and press EXECUTE to continue. Compliance will cause CTRACES to return to the menu of Points to Make Up suboptions.

3.2.1.3 Not Sorted - The final technique for examining deficit scores is to leave them unsorted. Upon selecting this option, the following message will appear:

TURN THE PRINTER ON, ALIGN FORMS, PRESS EXECUTE TO CONTINUE.

Once this instruction has been followed, the listing will begin. A partial example of the unsorted listing is provided below:

NOT SORTED

FACTOR		DEFICIT	%DEFICIT	CUMDEF	CUM%DEF
2.A.1	ACTNSBYMAN	12.77	28.19	12.77	28.19
2.A.1.2	DISPERSION	.98	2.17		
2.A.1.3	COVER	3.05	6.73		
2.A.1.4	CAMOUFLAGE	1.17	2.58		
2.A.1.5	SECURITY	1.02	2.25		
2.A.1.6	RECONPATRL	1.19	2.62		
2.A.1.7	COMBATPTRL	.88	1.94		
2.A.1.8	ELECTRONIC	.26	.56		
2.A.1.10	ENEMYAIR	1.75	3.87		
2.A.1.11	POWS	.80	1.76		
2.A.1.12	CASUALTIES	1.68	3.70		
2.A.2	CMD-CONTRO	6.29	13.90	19.06	42.09
2.A.2.1	MANEUVER	.88	1.95		
2.A.2.2	HIGHERHQ	.36	.79		
2.A.2.3	ORGANICFIR	.70	1.55		
2.A.2.4	ATTACHFIRE	.00	.00		
2.A.2.5	NGF	.49	1.09		
2.A.2.7	LZCONTROL	.72	1.58		
2.A.2.8	INTELL	.60	1.33		
2.A.2.9	COMM	.75	1.66		
2.A.2.10	LOG	.45	.99		
2.A.2.11	CASUALTIES	.33	.73		
2.A.2.12	REPORTS	1.01	2.22		

In this listing, the MPS's are listed in their normal sequence, as are the tasks within each MPS. The four columns have the same definition identified earlier for the Sorted by Task option.

When the listing is finished, the computer will ask the user to turn off the printer and press EXECUTE to continue. Compliance causes CTRACES to return to the menu of Points to Make Up options.

3.2.2 Pareto Packages - An examination of Points to Make Up provides an indication of which tasks need remediation, but it does not provide any indication of how costly such remediation could be. The present option is designed to provide a graphic presentation of the trade-offs between the cost and the benefit of training.

Once the Pareto Packages option is selected from the main menu, the following submenu will appear:

1) PLOT PARETO POINTS
2) LIST PARETO POINTS
3) PLOT MAJOR OPTIONS
4) LIST MAJOR OPTIONS

ENTER THE NUMBER OF THE DESIRED OPTION:

These suboptions provide the user an opportunity to see how the various training options stand in relation to one another. The two Pareto options provide information about the optimal or most cost/beneficial training options, while the other two options provide information about the major training options without regard to the question of whether they are optimal.

As in the Points to Make Up options, each of these Pareto Packages options is preceded by a request to turn the printer on, align the forms, and press execute to continue. Also, following each Plot or Listing, there is a request to turn off the printer and press execute to continue. These instructions will not be reiterated in each of the sections that follow. Instead, the discussion will concentrate on the meaning and format of the output corresponding to each suboption.

3.2.2.1 Plot Pareto Points - An example of a Pareto Plot is provided in Figure 3-2. The Pareto frontier is the set of options which offer the highest benefit for a given cost, or cost the least for a given benefit. For CTRACES, benefit is reflected by Points Made Up (PMU). The asterisks on this plot correspond to the most cost-beneficial training options.

3.2.2.2 List Pareto Points - A less graphic, but more complete perspective on the Pareto frontier is provided by listing the Pareto Points. An example of a portion of this output is shown in Figure 3-3. Each package of training options (major option plus lectures) that is optimal for its cost is listed. The packages are ordered from least costly to most expensive and correspond directly to the points on the Pareto plot (shown in the previous section). Accompanying each package is its cost, its PMU, and the number of tasks on which enhanced training will occur (#ENH). Enhanced training occurs whenever a training option more than compensates for the deficit. Typically, enhanced training only occurs with the more expensive training options and, therefore, is not observed in the example which only lists the first few points on the Pareto frontier.

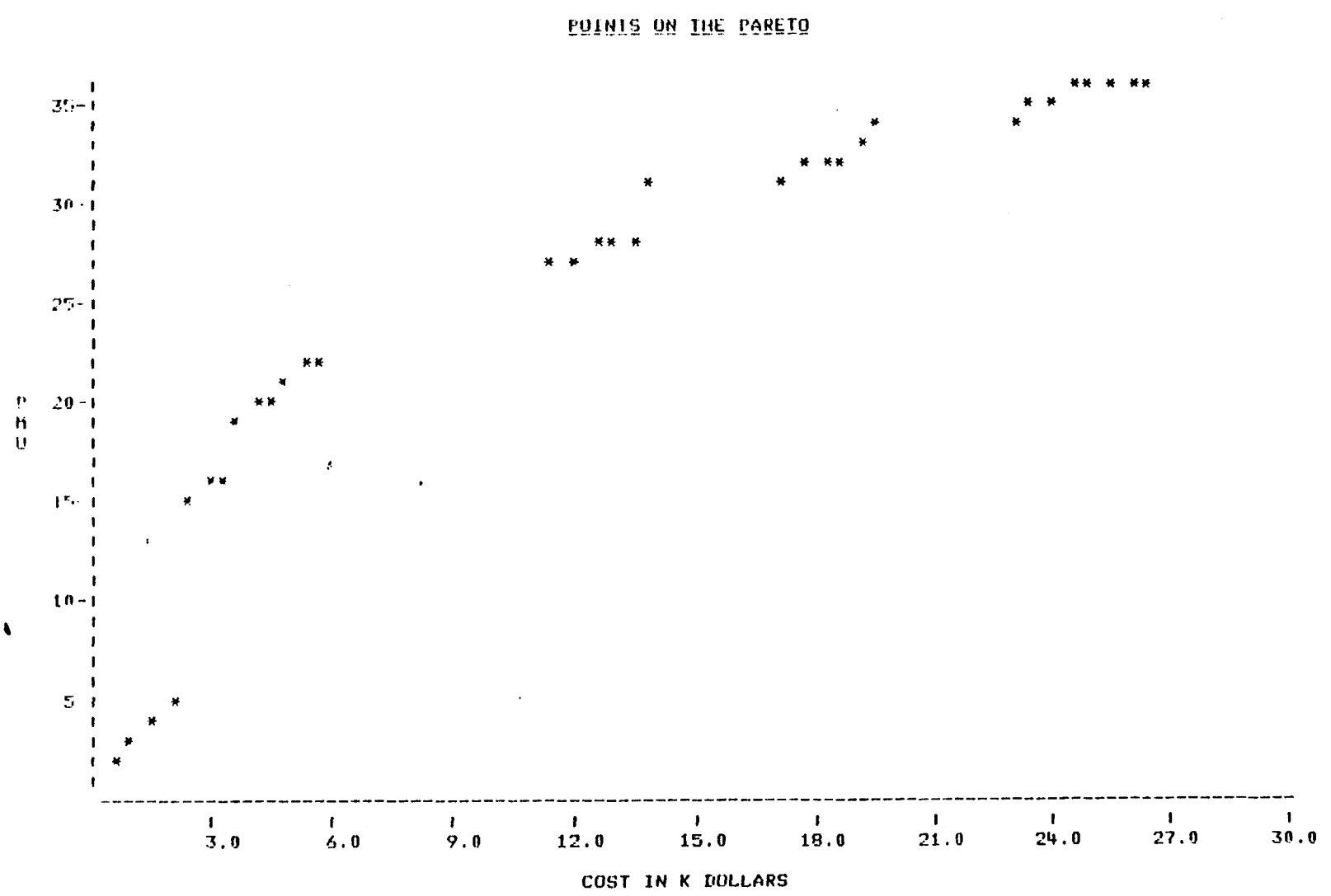


Figure 3-2

AN EXAMPLE OF POINTS ON THE PARETO

POINTS ON THE PARETO

	COST	PMU	#ENH
MAJOR OPTION: NONE	500	1.9633	0
LECTURES: L01			
	COST	PMU	#ENH
MAJOR OPTION: NONE	1000	3.0030	0
LECTURES: L01 L02			
	COST	PMU	#ENH
MAJOR OPTION: NONE	1500	3.8171	0
LECTURES: L01 L02 L05			
	COST	PMU	#ENH
MAJOR OPTION: NONE	2000	4.5278	0
LECTURES: L01 L02 L05 L08			
	COST	PMU	#ENH
MAJOR OPTION: CPX2	2374	14.8574	0
	COST	PMU	#ENH
MAJOR OPTION: CPX2	2874	15.7152	0
LECTURES: L01			
	COST	PMU	#ENH
MAJOR OPTION: CPX2	3374	15.7505	0
LECTURES: L01 L11			
	COST	PMU	#ENH
MAJOR OPTION: CPX3	3562	18.7071	0
	COST	PMU	#ENH
MAJOR OPTION: CPX3	4062	19.5648	0
LECTURES: L01			
	COST	PMU	#ENH
MAJOR OPTION: CPX3	4562	19.6001	0
LECTURES: L01 L11			

Figure 3-3

A PARTIAL LISTING OF POINTS ON THE PARETO FRONTIER

3.2.2.3 Plot Major Options - A somewhat more graphic presentation of the cost/benefit trade-offs associated with each major option can be obtained by selecting Plot Major Options. An example of this plot is shown in Figure 3-4. In this plot, each major option (without additional lectures) is plotted in the cost/benefit space. In addition, a mini-curve for lectures is plotted, with each additional point reflecting another lecture purchased. Thus, the first 2 on the mini-curve represents a package of eight accumulated lectures.

It should be emphasized that this plot of major options does not depict the optimal packages. Some of the points that are depicted are clearly dominated by other alternatives (for example, point G). Also, some cost/beneficial packages are not depicted; for instance, any package which combines a major option with some lectures. Nonetheless, this plot does offer a feeling for the contributions that the major options are making to the more complete Pareto analysis.

3.2.2.4 List Major Options - Just as it was possible to list the points on the Pareto plot, it is also possible to list the points on the major option plot. An example of this listing is provided in Figure 3-5. Notice first that the lectures are cumulative. In other words, each one represents a package which includes all of the earlier ones. They are ordered in terms of their PMU. The lecture with the greatest PMU appears first.

Also notice the four options at the bottom of the list. CPL stands for Combined Planning with the Navy, for either one or two days. REH stands for Rehearsal with the Navy, for either one or two days. None of these options permits an accurate cost assessment. Therefore, they are not included in the earlier cost/benefit

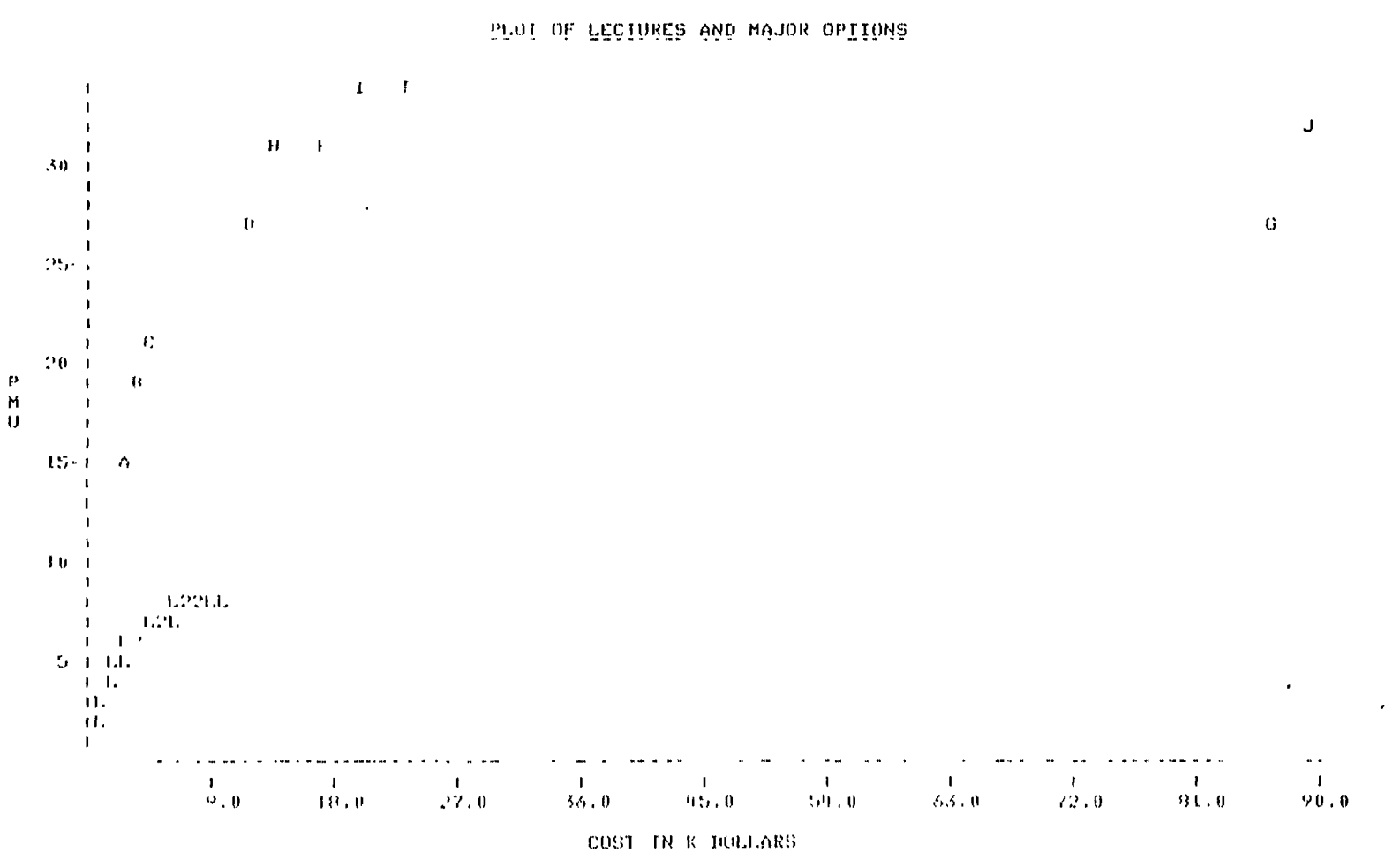


Figure 3-4

EXAMPLE OF A COST/BENEFIT PLOT OF LECTURES AND MAJOR OPTIONS

LIST OF LECTURES AND MAJOR OPTIONS

OPTION	COST	PMU	#ENH
L01	500	1.96	
+L02	1000	3.00	
+L05	1500	3.82	
+L08	2000	4.53	
+L27	2500	5.19	
+L07	3000	5.68	
+L26	3500	6.04	
+L03	4000	6.40	
+L29	4500	6.76	
+L30	5000	7.07	
+L04	5500	7.29	
+L16	6000	7.45	
+L31	6500	7.59	
+L34	7000	7.72	
+L12	7500	7.83	
+L09	8000	7.94	
+L15	8500	8.01	
+L11	9000	8.05	
+L13	9500	8.05	
A-CPX2	2374	14.86	0
B-CPX3	3562	18.71	0
C-CPX4	4750	21.27	5
D-FX2	11476	26.61	0
E-FX3	17214	30.83	7
F-FX4	22952	34.26	17
G-CAX	86411	26.95	7
H-CPX2,FX2	13850	30.78	0
I-CPX2,FX3	19588	34.03	7
J-CPX2,CAX	88785	32.48	7
CPU1		2.20	0
CPU2		2.44	0
PFH1		1.31	0
PFH2		1.96	0

Figure 3-5

A LIST OF LECTURES AND MAJOR OPTIONS

analyses. Instead, they are simply listed here with their points made up (PMU) and number of tasks with enhanced training (#ENH).

3.2.3 Specified Package - The final Main Menu option permits the user to examine the costs and benefits of particular training packages. Upon selecting this option, the following submenu will appear:

```
1) BEST PACKAGE FOR DOLLARS
2) CHEAPEST PACKAGE FOR PMU
3) COST/BENEFIT FOR UNIQUE PKG

ENTER THE NUMBER OF THE DESIRED OPTION:
```

These suboptions provide three techniques for identifying the package to be examined. The first two techniques use the Pareto plot to determine the optimal package given a specified cost or PMU. The final technique allows the user to construct an arbitrary package. These techniques are further clarified in the sections that follow.

3.2.3.1 Best Package for Dollars - Upon requesting this option, the user is first asked to specify the number of dollars he would like to spend. He should type the amount and then press EXECUTE. In the event that the amount is less than the cost of the cheapest package, CTRACES will display a message like the following:

```
ENTER THE NUMBER OF DOLLARS YOU WOULD LIKE TO SPEND: 10
YOU HAVE SPECIFIED FEWER DOLLARS THAN POSSIBLE TO GET
ANY POINTS MADE UP.  PLEASE SPECIFY A NUMBER GREATER THAN
OR EQUAL TO 500
ENTER THE NUMBER OF DOLLARS YOU WOULD LIKE TO SPEND:
```

(The box indicates the user's input.) After stipulating the problem, CTRACES offers another opportunity to specify a dollar amount.

A more reasonable entry yields the following type of display:

```
ENTER THE NUMBER OF DOLLARS YOU WOULD LIKE TO SPEND: 4000

                          COST      PMU      #ENH

MAJOR OPTION: CPX3        3562   18.7071       0

WOULD YOU LIKE TO SEE A PRINT BY TASK OF POINTS MADE UP?
```

In this case, CTRACES has listed the training package that offers the most benefit for $4000 or less. Besides listing the package, its cost, its PMU, and the number of tasks on which enhanced training is provided, CTRACES also asks whether the user wants a listing of the points made up for each task. Typing 'NO' or simply 'N' followed by EXECUTE returns CTRACES to the menu for Specified Packages. Typing 'YES' or 'Y' followed by EXECUTE begins the listing procedure.

If a listing is desired, CTRACES will ask the user to turn on the printer, align the forms, and then press EXECUTE. Once this is done, a listing similar to the partial one shown in Figure 3-6 will be printed. This listing first reiterates the earlier display and then offers a breakdown by task. The column marked SOURCE indicates whether the points made up derive from the major option (OPT) or a lecture (e.g., L12). The column marked ENH indicates whether the task will receive enhanced training. The column marked PMU indicates the points made up for the task. The column marked %PMU indicates the percent of the total points made up which are attributable to the particular task.

Once the listing is completed, the user is asked to turn off the printer and press EXECUTE to continue. Compliance with this request causes CTRACES to return to the menu for Specified Packages.

POINTS MADE UP BY TASK FOR SPECIFIED PACKAGE

		COST	PMU	#ENH
MAJOR OPTION: CPX3		3562	18.7071	0

FACTOR		SOURCE	ENH	PMU	%PMU
2.A.1	ACTNSBYMAR				
2.A.1.2	DISPERSION	OPT	N	.5905	3.1565
2.A.1.3	COVER		N	.0000	.0000
2.A.1.4	CAMOUFLAGE		N	.0000	.0000
2.A.1.5	SECURITY		N	.0000	.0000
2.A.1.6	RECONPATRL		N	.0000	.0000
2.A.1.7	COMBATPTRL		N	.0000	.0000
2.A.1.8	ELECTRONIC	OPT	N	.1534	.8198
2.A.1.10	ENEMYATR	OPT	N	1.0520	5.6237
2.A.1.11	POWS		N	.0000	.0000
2.A.1.12	CASUALTIES	OPT	N	1.0057	5.3759
2.A.2	CMD-CONTRO				
2.A.2.1	MANEUVER	OPT	N	.7934	4.2412
2.A.2.2	HIGHERHQ	OPT	N	.3222	1.7221
2.A.2.3	ORGANICFIR	OPT	N	.6335	3.3865
2.A.2.4	ATTACHFIRE		N	.0000	.0000
2.A.2.5	NGF	OPT	N	.4446	2.3764
2.A.2.7	LZCONTROL	OPT	N	.6455	3.4505
2.A.2.8	INTELL	OPT	N	.5414	2.8941
2.A.2.9	COMM	OPT	N	.6775	3.6215
2.A.2.10	LOG	OPT	N	.4036	2.1574
2.A.2.11	CASUALTIES	OPT	N	.2967	1.5858
2.A.2.12	REPORTS	OPT	N	.9063	4.8444

Figure 3-6

EXAMPLE OF POINTS MADE UP BY TASK FOR SPECIFIED PACKAGE

3.2.3.2 Cheapest Package for PMU - Upon selecting this option, the user is asked to specify the number of points that he would like to make up. This is entered by typing the number and pressing EXECUTE. Should that number be too large, a message like the following will appear:

```
ENTER THE NUMBER OF POINTS YOU WOULD LIKE TO MAKE UP: 50
YOU HAVE SPECIFIED MORE POINTS THAN CAN BE MADE UP WITH
ANY PACKAGE.  PLEASE SPECIFY A NUMBER LESS THAN OR EQUAL TO
36.332
ENTER THE NUMBER OF POINTS YOU WOULD LIKE TO MAKE UP:
```

(The box indicates user input.) Once a reasonable number is entered, a display like the following will appear:

```
ENTER THE NUMBER OF POINTS YOU WOULD LIKE TO MAKE UP: 15

                              COST        PMU       #ENH

MAJOR OPTION: CPX2            2874     15.7152         0
     LECTURES: L01

WOULD YOU LIKE TO SEE A PRINT BY TASK OF POINTS MADE UP?
```

This display indentifies the least expensive training package that provides at least as many PMU's as were indicated by the user.

After the optimal package is identified, CTRACES offers the user an opportunity to obtain a breakdown of the PMU for each task. This offer is rejected by typing 'N' then EXECUTE, or accepted by typing 'Y' then EXECUTE. Since this listing and the procedure behind it were explained earlier in Section 3.2.2.1, it will not be reiterated here. By typing 'N', either before or after obtaining the printout, CTRACES returns to the menu for Specified Packages.

3.2.3.3 Cost/Benefit for Unique Package - If the user already has a particular training package in mind, this final option allows him to specify the package and examine its cost/benefit trade-offs in relation to other packages. This examination involves three stages. The first is mandatory and the last two are optional. These stages are:

1) Specifying a Package;
2) Plotting the Package in relation to the Pareto frontier; and
3) Listing a breakdown of the PMU for each task.

These stages are detailed below.

Specifying a Package - Once the user elects to examine a unique package, CTRACES displays the following message:

```
                INDICATE THE MAJOR OPTION TO BE INCLUDED:

 1) NONE
 2) CPX2
 3) CPX3
 4) CPX4
 5) FX2
 6) FX3
 7) FX4
 8) CAX
 9) CPX2,FX2
10) CPX2,FX3
11) CPX2,CAX

        ENTER THE NUMBER OF THE DESIRED OPTION: 5
```

Since a package consists of a major option plus a set of lectures, CTRACES is simply providing an opportunity to first select the major option. The user should note that three of the major options are actually combinations of options. Also, one of the options permits the user to specify that his package does not contain a major option.

After entering a number followed by EXECUTE, the user is provided an opportunity to specify lectures. The first display for this is the following:

```
INDICATE LECTURES TO INCLUDE IN PACKAGE:

1) NONE
2) L27
3) ABOVE+L26
4) ABOVE+L29
5) ABOVE+L30
6) ABOVE+L31
7) ABOVE+L34
8) ABOVE+L12
9) USER DEF'D

ENTER THE NUMBER OF THE DESIRED OPTION: 6
```

In this menu, CTRACES has identified the lectures which can provide some benefit given the major option selected earlier. These lectures are listed in order based on PMU and offered as a combination of a lecture plus all lectures providing a greater PMU. In other words, when the user selects 6, he is specifying lectures L27, L26, L29, L30, and L31. This procedure for selecting lectures allows the user to choose the best set of lectures for the designated major option.

Assuming the user selects something other than USER DEF'D, CTRACES will next provide information about the package (this will be described shortly). If, however, USER DEF'D is chosen, CTRACES' next display is the following:

```
INDICATE LECTURES TO INCLUDE IN PACKAGE:

 1) L01    11) L13
 2) L02    12) L15
 3) L03    13) L16
 4) L04    14) L26
 5) L05    15) L27
 6) L07    16) L29
 7) L08    17) L30
 8) L09    18) L31
 9) L11    19) L34
10) L12

ENTER THE NUMBER(S) OF THE DESIRED OPTION(S): 1 6 5 8
```

Now the user can select any combination of lectures by entering the option numbers and pressing EXECUTE. Once this selection is made, however, CTRACES may display the following type of message:

```
THE FOLLOWING LECTURES PROVIDE NO ADDITIONAL POINTS:
L01
L07
L05
L09
PRESS EXECUTE TO CONTINUE...
```

This simply informs the user that some of the lectures which he has chosen are not providing any benefit. This can occur either because they offer training on tasks which did not show a deficit, or because the major option provides all the PMU on the tasks that they address. This display is merely informative, however, and pressing EXECUTE allows the CTRACES to continue.

No matter how a package is specified, CTRACES will next ask the user to turn on the printer, align the forms, and press EXECUTE. Compliance with this request yields a printout like the following:

SELECTED PACKAGE:

	COST	PMU	#ENH
MAJOR OPTION: FX2	13476	26.6071	0
LECTURES: L01 L07 L05 L09			

CHEAPER PACKAGE:

	COST	PMU	#ENH
MAJOR OPTION: FX2	11476	26.6071	0

BETTER PACKAGE:

	COST	PMU	#ENH
MAJOR OPTION: FX2	13476	28.2982	0
LECTURES: L27 L26 L29 L30			

This printout lists the cost, PMU, and number of enhanced tasks for ıe selected package, a cheaper package that provides at least as much benefit, and a better package that costs no more than the selected package. The cheaper and better packages are chosen from the Pareto set discussed earlier in Section 3.2.2. Following the printout, the user will be asked to turn off the printer and press EXECUTE. Compliance leads to the next stage for examining a unique package.

Plotting the Unique Package - At this point the user is asked if he would like to see a plot of the cheaper and better points. Entering 'NO' or 'N' followed by EXECUTE skips this stage. Entering 'YES' or 'Y' leads to the plot.

Upon electing to see a plot, the user is requested to turn on the printer, align the forms, and press EXECUTE. Once this is done, a plot similar to the one shown in Figure 3-7 is printed. This plot is the same as the Pareto plot discussed in Section 3.2.2.1 with the addition of three identifiers. These identifiers (S, C, and B) stand for the specified, cheaper, and better packages, and show where each package lies in relation to the Pareto curve.

Once the plot is completed, CTRACES asks the user to turn off the printer and press EXECUTE to continue. This leads to the third stage for examining a unique package.

Listing a Breakdown by Task - At this point, CTRACES asks whether the user would like to see a printout of the points made up for each task. Entering 'N' causes CTRACES to return to the menu of specified package options. Entering 'Y' begins the sequence for obtaining a

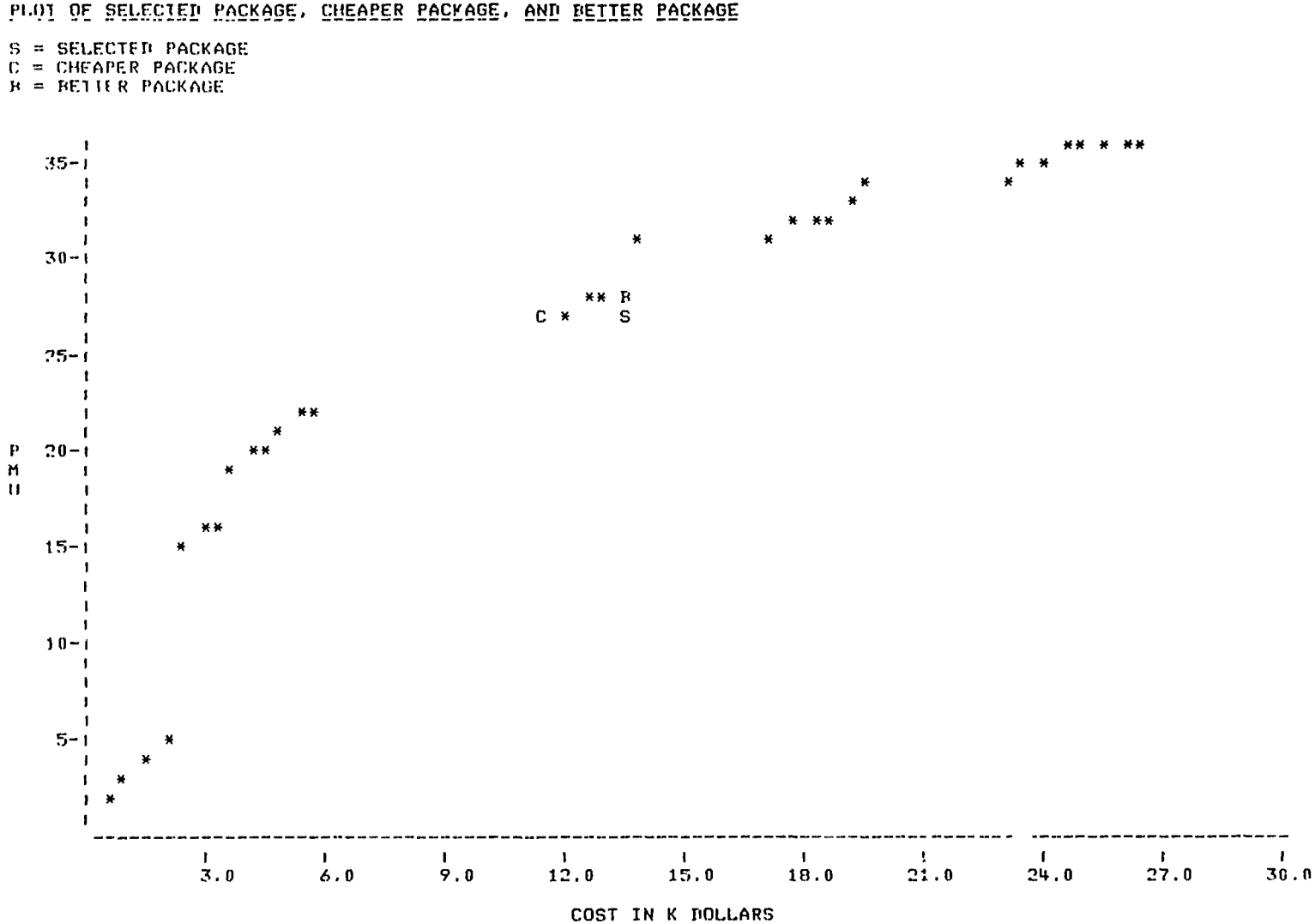


Figure 3-7

EXAMPLE OF A PLOT OF SELECTED PACKAGE, CHEAPER PACKAGE, AND BETTER PACKAGE

printout of the PMU attributable to each task for the specified package. Since this printout and the procedure behind it are the same as those described earlier in Section 3.2.3.1, they will not be reviewed again here. Once the printout is finished, however, CTRACES returns to the menu of Specified Package options.

4.0 LOGGING OFF

When a CTRACES analysis is completed, the user should log off and shut down the system. This is done by first waiting until CTRACES reaches a menu. Then, the diskette can be removed. Finally, the power can be turned off for both the computer and the printer. The only critical aspects of this sequence are that the diskette should not be removed unless CTRACES is expecting user input, and the power should not be turned off until the diskette is removed.